CLAIMS

1. A method of creating a composite broad area field electron emitter within an electrode structure that is at least partly preformed, the method comprising the steps of:

   a) providing a masking layer on selected areas of said electrode structure, to define masked areas and unmasked areas of said electrode structure;

   b) after step a), applying at least a first particulate constituent and a second constituent to said unmasked areas of said electrode structure, such that particles of said first constituent are selectively directed towards desired locations within said unmasked areas, thereby avoiding other locations of said unmasked areas; and

   after step b):

   c) removing said masking layer from said selected areas, together with any stray quantities of said constituents on said masking layer; and

   d) processing said constituents to create a broad area field electron emission material having emission sites in said desired locations of said electrode structure.

2. A method according to claim 1, wherein step d) is carried out after step c).

3. A method according to claim 1 or 2, wherein said particles are applied in step b) as a plurality of electrically conductive particles in a solution or colloidal dispersion of an electrically insulating material or a chemical precursor therefor and the process of step d) results in said electrically conductive particles being coated in said electrically insulating material.

4. A method according to claim 3, wherein the process of step d) includes removing fugitive components of said solution or dispersion.

5. A method according to claim 3 or 4, wherein a liquid component of said solution or dispersion has dissolved in it a chemical precursor for said electrically insulating material, and the method comprises decomposing said precursor by heat, ultra-violet light or other means to form said electrically insulating material.

6. A method according to claim 5, where said precursor is in the form of a sol-gel.

7. A method according to claim 5 or 6, where said precursor comprises a soluble polymer.

8. A method according to claim ~~1~~ or 2, wherein said particles comprise electrically conductive particles pre-coated with an electrically insulating material.

9. A method according to any of claims 3 to 8, wherein said electrically insulating material comprises silica.

10. A method according to any of the preceding claims, wherein step (b) comprises spray applying said first and second constituents onto said selected areas of said electrode structure, through apertures which are provided on said electrode structure and which direct said particles of said first constituent selectively towards said desired locations.

11. A method according to claim 10, wherein said apertures are defined by parts of said electrode structure which overlie recesses formed in said electrode structure, such that said first and second constituents are directed selectively towards the bottoms of said recesses rather than side walls thereof.

12. A method according to claim 11, wherein said recesses have side walls which slope inwardly towards the bottoms of the recesses.

13. A method according to claim 12, including the step of forming each said recess by a wet-etch process which forms an undercut below the respective part of said electrode structure which overlies the respective recess.

14. A method according to claim 3 or 4, where said electrically insulating material is in the form of a dispersion of colloidal or fine particles which subsequently are sintered together by the action of heat to form a solid phase.

15. A method according to claim 1 or 2, including the step of applying to said particles a metal and subsequently oxidising that metal to form an electrically insulating material.

16. A method according to claim 15, wherein said metal is applied also to a cathode track.

17. A method according to claim 15 or 16, wherein said metal is applied by electroplating.

18. A method according to any of the preceding claims, wherein said particles are electrically conductive particles.

19. A method according to claim 18, wherein said electrically conductive particles comprise graphite.

20. A method according to claim 18 or 19, wherein the process of step d) results in said conductive particles each with a layer of electrically insulating material disposed in a first location between said conductive surface and said particle, and/or in a second location between said particle and the environment in

which the electrode structure is disposed, such that at least some of said particles form electron emission sites at said first and/or second locations.

21. A method according to claim 20, including the step of adding to said conductive particles and/or layers of electrically insulating material further layers to promote electron emission.

22. A method according to any of the preceding claims, including a further step of curing or part-curing between steps b) and c).

23. A method according to any of the preceding claims, wherein said processing step d) includes curing.

24. A method according to any of the preceding claims, wherein said electrode structure has preformed emitter cells and said desired locations are within said emitter cells.

25. A method according to any of the preceding claims, wherein each of said desired locations comprises the bottom of a hole.

26. A method according to any of the preceding claims, wherein each of said desired locations is at an electrically conductive surface.

27. A method according to any of the preceding claims, wherein said particles are applied in a carrier in step b) and the method includes the step of subsequently removing excess of said carrier from said electrode structure.

28. A method according to claim 27, wherein said excess of said carrier is removed by a squeegee or similar means.

29. A method according to any of the preceding claims, wherein said selective direction of said particles is effected by electrophoresis.

30. A method according to any of the preceding claims, wherein said masking layer is provided in step (a) as part of a process to form at least part of said electrode structure, prior to carrying out step (b).

31. A method according to any of the preceding claims, wherein said second constituent is a precursor for an electrical insulator, which is formed in step (d).

32. A method of creating a field electron emitter, substantially as hereinbefore described with reference to the accompanying drawings.

33. A field electron emitter created by a method according to any of the preceding claims.

34. A field electron emission device comprising a field electron emitter according to claim 33, and means for subjecting said emitter to an electric field in order to cause said emitter to emit electrons.

35. A field electron emission device according to claim 34, comprising a substrate with an array of patches of said field electron emitters, and control electrodes with aligned arrays of apertures, which electrodes are supported above the emitter patches by insulating layers.

36. A field electron emission device according to claim 35, wherein said apertures are in the form of slots.

37. A field electron emission device according to any of claims 34 to 36, comprising a plasma reactor, corona discharge device, silent discharge device, ozoniser, an electron source, electron gun, electron device, x-ray tube, vacuum gauge, gas filled device or ion thruster.

38. A field electron emission device according to any of claims 34 to 37, wherein the field electron emitter supplies the total current for operation of the device.

39. A field electron emission device according to any of claims 34 to 38, wherein the field electron emitter supplies a starting, triggering or priming current for the device.

40. A field electron emission device according to any of claims 34 to 39, comprising a display device.

41. A field electron emission device according to any of claims 34 to 39, comprising a lamp.

42. A field electron emission device according to claim 41, wherein said lamp is substantially flat.

43. A field electron emission device according to any of claims 34 to 42, wherein said emitter is connected to an electric driving means via a ballast resistor to limit current.

44. A field electron emission device according to claims 35 and 43, wherein said ballast resistor is applied as a resistive pad under each said emitting patch.

45. A field electron emission device according to any of claims 34 to 44, wherein said emitter material and/or a phosphor is/are coated upon one or more one-dimensional array of conductive tracks which are arranged to be addressed by electronic driving means so as to produce a scanning illuminated line.

46. A field electron emission device according to claim 45, including said electronic driving means.

47. A field electron emission device according to any of claims 34 to 46, wherein said field emitter is disposed in an environment which is gaseous, liquid, solid, or a vacuum.

48. A field electron emission device according to any of claims 34 to 47, comprising a cathode which is optically translucent and is so arranged in relation to an anode that electrons emitted from the cathode impinge upon the anode to cause electro-luminescence at the anode, which electro-luminescence is visible through the optically translucent cathode.

49. A field electron emission device, substantially as hereinbefore described with reference to the accompanying drawings.